ECOSYSTEM STATUS INDICATORS

Ecosystem or Community Indicators

Alaska Native Traditional Environmental Knowledge of Climate Regimes

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Alaska Natives who traditionally inhabitant marine ecosystems accumulate a great deal of place-based knowledge about the environment with which they interact through daily observation and experience. Environmental changes associated with successive climate regimes have been recognized and captured by the knowledge systems of Alaska Natives. Traditional environmental knowledge (TEK) is useful to natural resource managers by drawing their attention to environmental changes or by corroborating scientifically described transitions between climate regimes. To illustrate this, a brief qualitative time series organized into three generally accepted climate regimes in the Bering Sea Aleutian Islands (BSAI) region has been constructed with information extracted from the *NOAA Fisheries Alaska Native Traditional Environmental Knowledge Database*. References in text refer to page numbers of individual observations in (Sepez et al. 2003; see also Sepez 2003). It should be noted that the information compiled in the *NOAA Fisheries Alaska Native Traditional Environmental Knowledge Database* was not necessarily elicited in response to specific questions about climatic changes. Additional research is needed to more closely correlate Alaska Native TEK with scientific observations in the BSAI region.

- **1947 – 1975**

In the vicinity of St Lawrence, the early half of the 1900s was characterized by calm weather and predictable ice formation (1). Around Savoonga ice would have begun to solidify by October in the 1930s and 1940s. People's perceptions of winter were largely based on the hunting activities made possible by solid ice formation (16,1). In the mid 1940s the area from Gambell north to Nome appeared to be solid ice (11). Observations beginning in the later part of this period of changes in sea ice formation, from solid to increasingly patchy, were understood to affect walrus migration (11). Since the 1960s early spring break-up of sea ice may have contributed to observed declines in spotted seal populations (19). Rising sea levels and corresponding coastal erosion became a problem, marking significant changes along the coastline from the 1960s to early 1970s and rendering the harvesting of sculpins unusually difficult (7).

- **1976/1977 – 1988**

Throughout the BSAI region and beginning in the late 1970s, winds increased in frequency and intensity and shifted somewhat to the south, average temperatures warmed, and ice melted or moved away from shorelines early (5, 16). Changed wind patterns additionally affected wave patterns, bringing about higher waves and increasing erosion from heightened wave energy hitting the coasts. High winds and waves make it difficult for people to use boats for hunting, near-shore sea beds are affected by coastal erosion and wave energy leading to destruction of kelp colonies and other bottom dwelling plants, which negatively affects shallow feeders such as eiders which depend on these plants (17). Both shifting winds and warmer temperatures contributed to delayed ice formation (19). Ice began to remain unstable throughout the cold season and melt earlier and more rapidly in the springtime in the region around Elim (15). While most seal species seemed to be doing well, spotted seal populations began to decline in the 1960s and 1970s which could be have been due to young seals becoming stranded when the ice melted prematurely (19).

- **1989 – 1998**

Increased westerly winds seem to be part of a trend in changing wind patterns which contribute to delays in the packing of ice and a delayed freeze, sometimes occurring as late as December (3, 11). Precipitation patterns have shifted, with the major snowfalls of the year coming in late winter and early spring (19). Increasingly frequent mild winters and warm springs seemed to correspond with bad hunting seasons for harbor and spotted seals (22). In 1998 a significant decline of seabird populations which may have been

weather-related was observed across the BSAI. Decreases in salmon populations, such as Yukon River Chinook salmon, and clams in Mekoryuk Bay, as well as increases in other shellfish were observed during this period (13). Ice formation patterns were delayed during this period when ice was not consistently solidified until early to mid December as opposed to mid October (16). This indicates that sea ice was formed by cold winds and does not contain the nutrients which are important during spring thaws and come from the nutrient-rich sea bottom. Less snow and colder winters were observed, especially in the winter of 1998/1999. Between 1996 and 1998, when spring weather arrived early, reduced sea ice, heightened wave action and subsequent increased sedimentation may have contributed to the poor health of walrus populations and was also detrimental to young, near shore spotted seal populations in the vicinity of Nome (19).